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ABSTRACT

The objectives of this handbook are to assist K-8 classroom teachers in launching an activity-oriented metric program that provides learning experiences in the measurement strands of linear, mass, and temperature, and to assist metric coordinators in planning metric awareness workshops for teachers, parents, and various community organizations. Detailed instructions are given for setting up a metric activity station. The pages of the handbook are designed to be used as instructions at various metric activity stations. (MP)

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# Handbook of Classroom and Workshop

# Metric Activity Stations

STATE BOARD OF EDUCATION
ILLINOIS OFFICE OF EDUCATION

Dr. Joseph M. Cronin, Superintendent

SE 028 425

NOTE: THIS HANDBOOK IS DESIGNED TO BE OF A LOOSE LEAF NATURE SO THAT ALL PAGES MAY BE READILY REMOVED AND PLACED AT ACTIVITY STATIONS. WORKSHEETS A AND B MAY BE DUPLICATED FOR STUDENT USE OR TRANSFERRED TO DATA CARDS TO BE PLACED AT EACH STATION.

## HANDBOOK OBJECTIVES

THIS HANDBOOK REPRESENTS BUT ONE OF SEVERAL WAYS TO PRESENT METRIC ACTIVITIES TO CHILDREN AND ADULTS.

THE OBJECTIVES OF THIS HANDBOOK ARE TWO-FOLD -

1. TO ASSIST K-8 CLASSROOM TEACHERS IN LAUNCHING AN ACTIVITY-ORIENTED METRIC PROGRAM THAT PROVIDES LEARNING EXPERIENCES IN THE MEASUREMENT STRANDS OF LINEAR, MASS AND TEMPERATURE.

2. TO ASSIST METRIC COORDINATORS IN PLANNING METRIC AWARENESS WORKSHOPS FOR TEACHERS, PARENTS AND VARIOUS COMMUNITY ORGANIZATIONS.

DURING THE PAST TWO YEARS THESE ACTIVITIES HAVE BEEN FIELD TESTED IN ELEMENTARY CLASSROOMS IN LANARK, ROCKFORD, FREEPORT, QUINCY, VANDALIA AND NUMEROUS OTHER SCHOOL DISTRICTS AS WELL AS IN OVER 100 TEACHER INSTITUTES AND PARENT WORKSHOPS. ALTHOUGH THIS HANDBOOK CONTAINS ACTIVITIES THAT STRESS THE MAJOR METRIC STRANDS AT THE ELEMENTARY GRADE LEVEL, IT IS NOT COMPLETE WITHIN ITSELF. THE ACTIVITIES MAY BE READILY MODIFIED BY THE CLASSROOM TEACHER OR METRIC COORDINATOR TO MEET THE NEEDS OF THE GROUP FOR WHICH THE INSTRUCTION IS BEING PLANNED.

## THE METRIC ACTIVITY STATION

A METRIC ACTIVITY STATION IS A PLACE IN THE CLASSROOM WHERE AN ACTIVITY OR A GROUP OF RELATED ACTIVITIES MAY BE PERFORMED - I.E. A TABLE, DESK TOP, WALL COUNTER, OR AN AREA ON THE FLOOR OR WALL. THE COMPONENTS OF THE METRIC ACTIVITY STATION ARE:

1. A STATION NUMBER SIGN THAT IS POSTED IN AN APPROPRIATE PLACE WITHIN THE STATION.

2. A SET OF STATION INSTRUCTIONS THAT TELLS THE STUDENT EXACTLY WHAT IS TO BE DONE IN ORDER TO PERFORM THE STATION ACTIVITY. THIS SET OF INSTRUCTIONS IS TO BE POSTED ALONGSIDE THE STATION NUMBER SIGN.

3. EQUIPMENT, SUPPLIES AND MATERIALS THAT ARE NECESSARY IN ORDER TO PERFORM THE ACTIVITY IN ACCORDANCE WITH THE POSTED INSTRUCTIONS. THESE MAY INCLUDE THOSE ITEMS TO BE ESTIMATED AND MEASURED, THE MEASURING DEVICE(S) SUCH AS RULES, SCALES AND BALANCES, THERMOMETERS, ETC. AND ANY OTHER ITEMS NECESSARY TO PERFORM THE ACTIVITY. THESE ITEMS SHOULD BE LISTED ON THE STATION INSTRUCTION SHEET. THIS LISTING WILL ENABLE A STUDENT TO TAKE AN INVENTORY OF WHAT IS NEEDED IN ORDER TO PERFORM THE ACTIVITY.

4. A WORKSHEET OR DATA CARD UPON WHICH A STUDENT RECORDS FIRST THE ESTIMATE AND THEN THE ACTUAL MEASUREMENT THAT THE STATION INSTRUCTIONS REQUESTS.

5. PROVISIONS FOR SELF-CORRECTING - (OPTIONAL) TO ENABLE THE STUDENT TO SEE HOW WELL HE OR SHE HAS PERFORMED IN COMPLETING THE STATION ACTIVITY, IT IS SOMETIMES DESIRABLE TO PLACE THE CORRECT MEASUREMENT ANSWER IN A STRATEGIC LOCATION WITHIN THE STATION. HOWEVER, MANY CLASSROOM TEACHERS CHOOSE NOT TO UTILIZE THIS COMPONENT BUT INSTEAD, HOLD A WRAP-UP SESSION WITH THE STUDENTS AT AN APPROPRIATE TIME WHEN ANSWERS OBTAINED ARE SHARED AND DISCUSSED.

## STATION SEQUENCE AND WORKSHEET FORMAT

THE ARRANGEMENT OF THE ACTIVITIES AS THEY APPEAR ON THE ENCLOSED WORKSHEETS A AND B MAY BE QUITE FLEXIBLE DEPENDING UPON THE NEEDS OF THE CLASS OR WORKSHOP AND THE APPROACH SELECTED BY THE INSTRUCTOR. GENERALLY, INSTRUCTORS PREFER TO HAVE THE ACTIVITIES WITHIN A STRAND CLUSTERED TOGETHER--THOSE REPRESENTING LINEAR ARE IN SEQUENCE AS WELL AS THOSE REPRESENTING THE STRANDS OF MASS AND TEMPERATURE. WITHIN THE LINEAR AND MASS CLUSTERS THE ACTIVITIES MAY BE ARRANGED FROM LARGE BASIC UNIT TO SMALL BASIC UNIT OF MEASUREMENT OR VICE VERSA--I.E. METER TO MILLIMETER, GRAM TO KILOGRAM.

## LARGE GROUPS

TO FACILITATE A LARGE GROUP WORKSHOP WHEREBY ALL 26 STATIONS ARE UTILIZED, THE GROUP IS FIRST DIVIDED INTO SMALLER GROUPS CONSISTING OF 2 OR 3 PARTICIPANTS PER GROUP. EACH SMALL GROUP IS THEN ALLOWED TO SELECT THEIR OWN SEQUENCE IN COMPLETING THE ACTIVITIES AT THE 26 STATIONS. IT IS NOT NECESSARY TO FOLLOW THE SET SEQUENCE OF STATIONS 1,2,3...26 IN ORDER FOR PARTICIPANTS TO EXPERIENCE MAXIMUM LEARNING AT THE STATIONS.

## TITLE I AND SPECIAL EDUCATION

THESE STATION ACTIVITIES MAY ALSO BE USED TO PROVIDE MEANINGFUL INSTRUCTION TO TITLE I MATHEMATICS CLASSES AND TO GROUPS OF SPECIAL EDUCATION STUDENTS. TO FACILITATE INSTRUCTION FOR THESE SPECIAL GROUPS OF LEARNERS CASSETTE TAPES CONTAINING SIMPLE STEP-BY-STEP INSTRUCTIONS ARE AVAILABLE FROM THE ILLINOIS OFFICE OF EDUCATION.

# METRIC WORKSHEET A

| Station | My Estimate | My Measurement |
|---|---|---|
| 1. The length of this room to the nearest meter is- | _____ | _____ |
| 2. My height to the nearest centimeter is- | _____ | _____ |
| 3. The air travel distance from my city to Rockford in kilometers is- | _____ | _____ |
| 4. The length of this table to the nearest tenth(0.1) meter is- | _____ | _____ |
| 5. The top inside diameter of the blue oleo dish to the nearest centimeter is- | _____ | _____ |
| 6. The length of the envelope to the nearest centimeter is- | _____ | _____ |
| 7. The width of the head of the screw to the nearest millimeter is- | _____ | _____ |
| 8. Stick Man -- See station instructions | _____ | _____ |
| 9. The area of the envelope in square centimeters is- | _____ | _____ |
| 10. The volume of the plastic block in cubic centimeters is- | _____ | _____ |
| 11. The capacity of my coffee or coke cup in milliliters is- | _____ | _____ |
| 12. The capacity of the bucket in liters is- | _____ | _____ |
| 13. The mass of my piece of candy to the nearest gram is- | _____ | _____ |
| 14. The mass of my cookie to the nearest gram is- | _____ | _____ |
| 15. My mass to the nearest kilogram is- | _____ | _____ |
| 16. The temperature of this room in Celsius degrees is- | _____ | _____ |
| 17. The temperature of the fountain water in Celsius degrees is- | _____ | _____ |
| 18. The outside temperature in Celsius degrees is- | _____ | _____ |
| 19. My body temperature in degrees Celsius is- | _____ | _____ |
| 20. My dress/shirt size in metric is_____; my metric shoe size is- | _____ | _____ |

OVER

## METRIC WORKSHEET B

LINEAR

| Station | My Estimate | My Measurement |
|---|---|---|
| 1. The length of this room to the nearest meter is- | _____ | _____ |
| 2. The length of this table to the nearest tenth(0.1) meter is- | _____ | _____ |
| 3. Stick Man -- See station instructions | _____ | _____ |
| 4. Complete the "Metric Me" sheet; place your estimates on the sheet in parenthesis alongside of your measurements. | _____ | _____ |
| 5. The top inside diameter of the blue oleo dish to the nearest centimeter is- | _____ | _____ |
| 6. The length of the envelope to the nearest centimeter is- | _____ | _____ |
| 7. My height to the nearest centimeter is- | _____ | _____ |
| 8. The width of the head of the screw to the nearest millimeter is- | _____ | _____ |
| 9. The thickness and width of the wooden block in millimeters is- | _____ thick | _____ thick |
| | _____ wide | _____ wide |
| 10. The air travel distance from my city to Rockford in kilometers is- | _____ | _____ |
| 11. My dress/shirt size in metric is_____; my metric shoe size is- | _____ | _____ |
| 12. The area of the envelope in square centimeters is- | _____ | _____ |
| 13. The land area in hectares of the Brantner farm is- | _____ | _____ |
| 14. The volume of the plastic block in cubic centimeters is- | _____ | _____ |
| 15. The volume of the bolt in cubic centimeters is- | _____ | _____ |
| 16. The capacity of the bucket in liters is- | _____ | _____ |
| 17. The capacity of my coffee or coke cup in milliliters is- | _____ | _____ |

OVER

## METRIC WORKSHEET A

| Station | My Estimate | My Measurement |
|---|---|---|
| 1. The length of this room to the nearest meter is- | _____ | _____ |
| 2. My height to the nearest centimeter is- | _____ | _____ |
| 3. The air travel distance from my city to Rockford in kilometers is- | _____ | _____ |
| 4. The length of this table to the nearest tenth(0.1) meter is- | _____ | _____ |
| 5. The top inside diameter of the blue oleo dish to the nearest centimeter is- | _____ | _____ |
| 6. The length of the envelope to the nearest centimeter is- | _____ | _____ |
| 7. The width of the head of the screw to the nearest millimeter is- | _____ | _____ |
| 8. Stick Man -- See station instructions | _____ | _____ |
| 9. The area of the envelope in square centimeters is- | _____ | _____ |
| 10. The volume of the plastic block in cubic centimeters is- | _____ | _____ |
| 11. The capacity of my coffee or coke cup in milliliters is- | _____ | _____ |
| 12. The capacity of the bucket in liters is- | _____ | _____ |
| 13. The mass of my piece of candy to the nearest gram is- | _____ | _____ |
| 14. The mass of my cookie to the nearest gram is- | _____ | _____ |
| 15. My mass to the nearest kilogram is- | _____ | _____ |
| 16. The temperature of this room in Celsius degrees is- | _____ | _____ |
| 17. The temperature of the fountain water in Celsius degrees is- | _____ | _____ |
| 18. The outside temperature in Celsius degrees is- | _____ | _____ |
| 19. My body temperature in degrees Celsius is- | _____ | _____ |
| 20. My dress/shirt size in metric is_____; my metric shoe size is- | _____ | _____ |

OVER

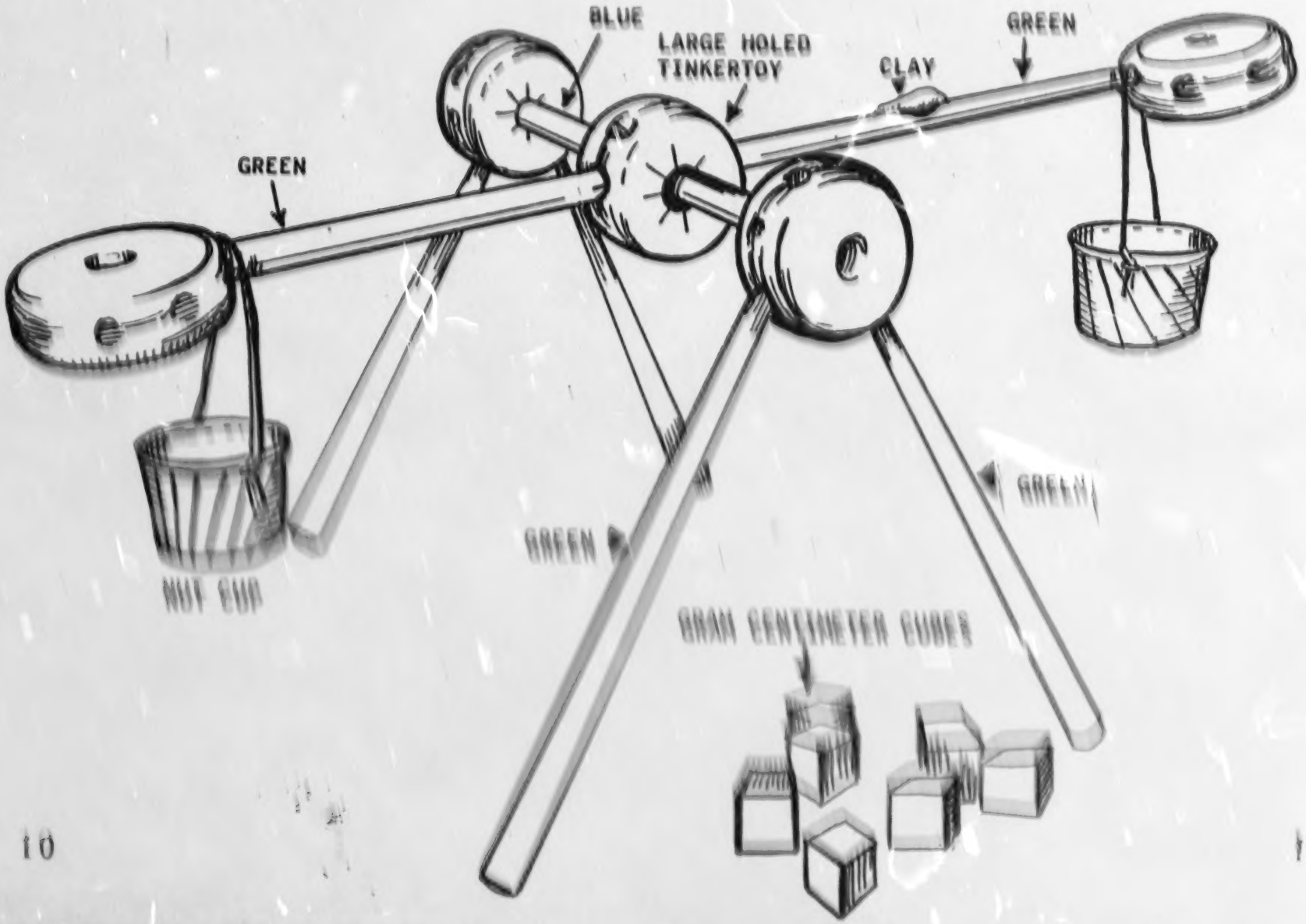
## METRIC WORKSHEET B

LINEAR

| Station | My Estimate | My Measurement |
|---|---|---|
| 1. The length of this room to the nearest meter is- | | |
| 2. The length of this table to the nearest tenth(0.1) meter is- | | |
| 3. Stick Man -- See station instructions | | |
| 4. Complete the "Metric Me" sheet; place your estimates on the sheet in parenthesis alongside of your measurements. | | |
| 5. The top inside diameter of the blue oleo dish to the nearest centimeter is- | | |
| 6. The length of the envelope to the nearest centimeter is- | | |
| 7. My height to the nearest centimeter is- | | |
| 8. The width of the head of the screw to the nearest millimeter is- | | |
| 9. The thickness and width of the wooden block in millimeters is- | thick | thick |
| | wide | wide |
| 10. The air travel distance from my city to Rockford in kilometers is- | | |
| 11. My dress/shirt size in metric is_____; my metric shoe size is- | | |
| 12. The area of the envelope in square centimeters is- | | |
| 13. The land area in hectares of the Brantner farm is- | | |
| 14. The volume of the plastic block in cubic centimeters is- | | |
| 15. The volume of the bolt in cubic centimeters is- | | |
| 16. The capacity of the bucket in liters is- | | |
| 17. The capacity of my coffee or coke cup in milliliters is- | | |

OVER

# TINKERTOY SCALE BALANCE



STATION #1

MATERIALS NEEDED: METER STICK OR TRUNDLE WHEEL, WORKSHEET

# Estimate and then measure, the length of this room to the nearest meter.

Record your results on your worksheet.

MATERIALS NEEDED: 200 CENTIMETER PAPER STRIP, WORKSHEET

STATION # 2

Estimate and then measure your height to the nearest centimeter.

14 Record your results on your worksheet. 15

MATERIALS NEEDED: OFFICIAL ILLINOIS ROAD MAP, KM SCALE CARD, WORKSHEET

STATION #3

Estimate and then measure the air travel distance from your city to Rockford in kilometers.

Record your results on your worksheet.

MATERIALS NEEDED: METER STICK, TABLE, WORKSHEET

STATION # 4

Estimate and then measure the length of this table to the nearest 0.1 of a meter.

Record your results on your worksheet.

MATERIALS NEEDED: OLEO DISH, CENTIMETER RULE, WORKSHEET

STATION #5

# Estimate and then measure the top inside diameter of the blue oleo dish to the nearest centimeter.

Record your results on your worksheet.

MATERIALS NEEDED: CENTIMETER RULE, WORKSHEET

STATION #6

Estimate and then measure the length of this envelope to the nearest centimeter.

Record your results on your worksheet.

MATERIALS NEEDED: FLAT HEADED SCREW, MILLIMETER RULE, WORKSHEET

STATION # 7

# Estimate and then measure the width of the head of the screw in millimeters.

Note - Use the millimeter scale on the lapel pin for your measurement.

Record your results on your worksheet.

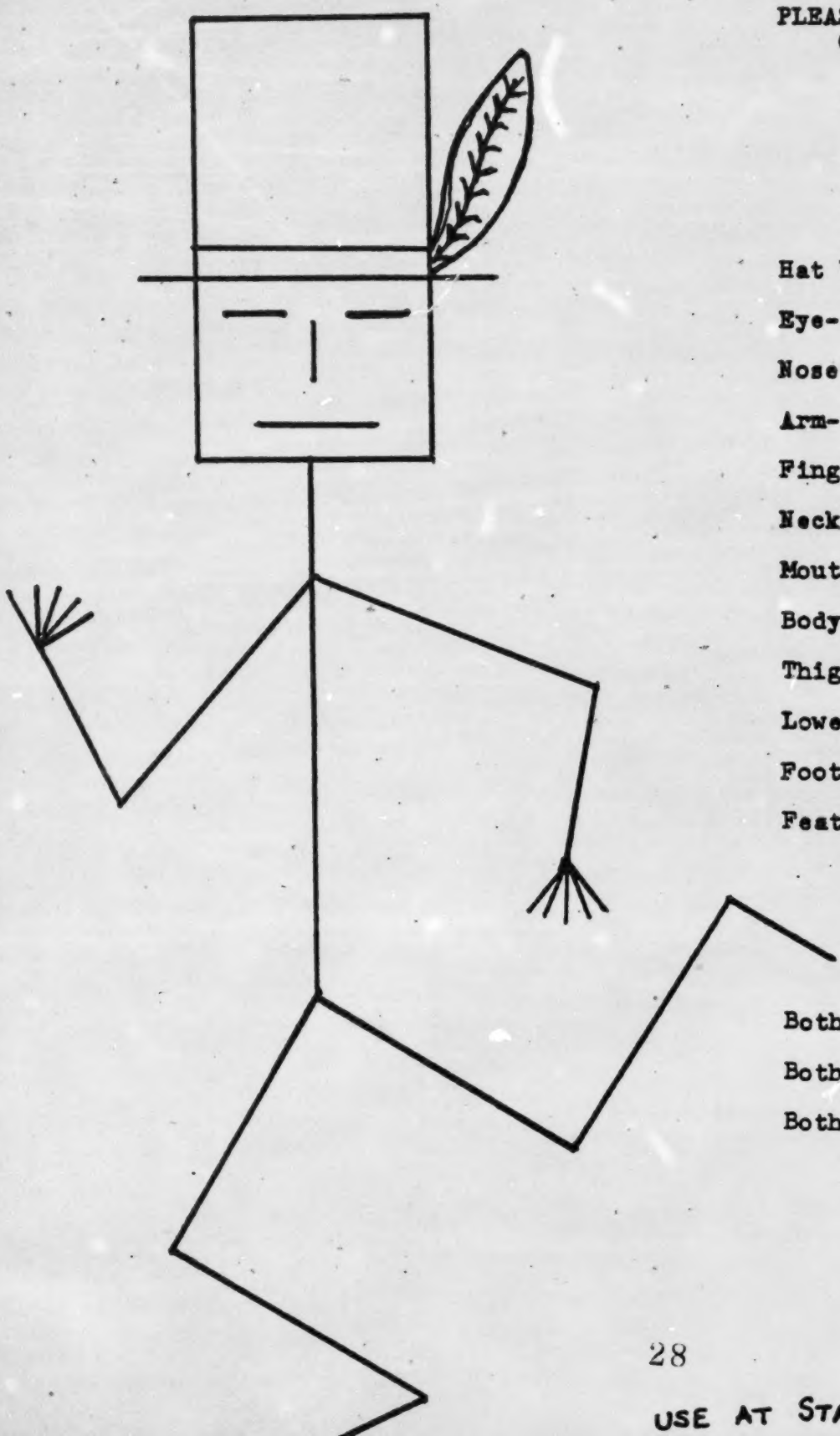
MATERIALS NEEDED: STICK MAN SHEET, CENTIMETER RULE, WORKSHEET

STATION #8

# Obtain a copy of the Stick Man and complete all estimates and measurements in centimeters.

Record your results on the Stick Man worksheet.

# STICK MAN



PLEASE MEASURE ME IN CENTIMETERS-

| | My Estimate | My Measurem |
|---|---|---|
| Hat brim- | ____ | ____ |
| Eye- | ____ | ____ |
| Nose- | ____ | ____ |
| Arm- | ____ | ____ |
| Finger- | ____ | ____ |
| Neck- | ____ | ____ |
| Mouth- | ____ | ____ |
| Body- | ____ | ____ |
| Thigh- | ____ | ____ |
| Lower leg- | ____ | ____ |
| Foot- | ____ | ____ |
| Feather- | ____ | ____ |
| Both arms- | ____ | ____ |
| Both legs- | ____ | ____ |
| Both feet- | ____ | ____ |



USE AT STATION #8

MATERIALS NEEDED: CENTIMETER RULE AND/OR SQUARE CENTIMETER GRID, WORKSHEET

STATION # 9

# Estimate and then measure the area of this envelope in square centimeters.

Record your results on your worksheet.

MATERIALS NEEDED: PLASTIC OR WOOD CUBE, CENTIMETER RULE, WORKSHEET

STATION # 10

# Estimate and then measure the volume of the plastic block in cubic centimeters.

Record your results on your worksheet.

MATERIALS NEEDED: DRINKING GLASS OR CUP, MILLILITER MEASURING CUP, WORKSHEET

STATION # 11

# Estimate and then measure the capacity of your coffee cup or coke cup in milliliters.

Note - Use the metric measuring cup to measure the capacity of your drinking cup.

Record your results on your worksheet.

MATERIALS NEEDED: BUCKET, LITER MEASURING CONTAINER, WORKSHEET

STATION #12

# Estimate and then measure the capacity of the bucket in liters.

Note:- Use the home made liter measuring vessel to pour water into the bucket.

Record your estimate and measurement on your worksheet.

MATERIALS NEEDED: FINGER TOY BALANCE; PIECE OF CANDY SUCH AS JELLY BEAN; ONE-GRAM CUBES (12); WORKSHEET

STATION #3 (1)

# Estimate and then measure the mass of a piece of candy to the nearest gram.

Note - You may now eat the piece of candy.

Record your results on your worksheet.

MATERIALS NEEDED; TINKER TOY BALANCE, KEY, GRAM CUBES, WORKSHEET

STATION #13 (2)

# Estimate and then measure the mass of the key in grams.

Record your estimate and measurement on your worksheet.

MATERIALS NEEDED: TINKER TOY BALANCE OR DUAL PAN BALANCE, COOKIE, ONE-GRAM CUBES (60), WORKSHEET

STATION #14 (1)

# Estimate and then measure the mass of a cookie in grams.

Note- You may now eat your cookie.

Record your results on your worksheet.

MATERIALS NEEDED: TINKER TOY BALANCE OR DUAL PAN BALANCE, GRAM CUBES (60), BAR OF SOAP, WORKSHEET

# Estimate and then measure the mass of a bar of soap.

Record your results on your worksheet.

MATERIALS NEEDED: METRIC BATHROOM SCALE, WORKSHEET

STATION # 15

# Estimate and then measure your mass to the nearest kilogram.

Record your results on your worksheet.

STATION # 16

MATERIALS NEEDED: CELSIUS THERMOMETER, WORKSHEET

# Estimate and then measure the temperature of this room in Celsius degrees.

Record your results on your worksheet.

MATERIALS NEEDED: CELSIUS THERMOMETER, WORKSHEET

STATION #17

# Estimate and then measure the temperature of the drinking fountain water in Celsius degrees.

Record your results on your worksheet.

MATERIALS NEEDED: CELSIUS THERMOMETER, WORKSHEET

STATION # 18

# Estimate and then measure the outside temperature in Celsius degrees.

Record your results on your worksheet.

STATION #19

MATERIALS NEEDED: CELSIUS THERMOMETER, WORKSHEET

# Estimate and then measure your body temperature in Celsius degrees.

Note - To measure your body temperature - place the thermometer in your armpit with the scale side toward your body. Place your arm firmly to your side and take a reading after three minutes.

Record your results on your worksheet.

MATERIALS NEEDED: METRIC DRESS APPAREL SIZE SHEET, WORKSHEET

STATION #20

# Record your metric size in-

a. Dress or shirt size

b. Shoe size

Record your sizes on your worksheet.

MATERIALS NEEDED: SMALL PLASTIC TOYS (4), TINKER TOY BALANCE, WORKSHEET

STATION #21

# Estimate and then arrange the four toys in order of their increasing mass. You may use the tinkertoy scale to verify your estimat

Note - This activity is an example of the direct comparison stage of measurement that can be used in primary grades.

Record your results on your worksheet.

MATERIALS NEEDED: TINKER TOY BALANCE, QUARTER COIN, SMALL WHITE BEANS, WORKSHEET

STATION #22

# Estimate and then measure the mass of a quarter in beans.

Note- This is an example of the non-standard stage of measurement. The Indians used a small see-saw scale similar to this one to determine the mass of small objects in their non-standard unit of mass which was the bean.

Record your results on your worksheet.

STATION #23

MATERIALS NEEDED: BOLT (ABOUT 5 CM LONG), GRADUATE CYLINDER, THREAD, WATER, WORKSHEET

# Estimate and then measure the volume of this bolt in cubic centimeters ($cm^3$)

Directions-

- 1. Fill the graduate to the 25 ml mark.
- 2. Gently lower the bolt into the water-it should be completely submerged.
- 3. Now- read the ml level of the water in the graduate.
- 4. Subtract the ml reading level in step #1 (25 ml) from that in step #3. This is the volume of the bolt and should be expressed in cubic centimeters ($cm^3$) since the bolt is of the solid state of matter.

Record your results on your worksheet.

MATERIALS NEEDED: "METRIC ME" SHEET, METRIC TAPE MEASURE, WORKSHEET

STATION #24

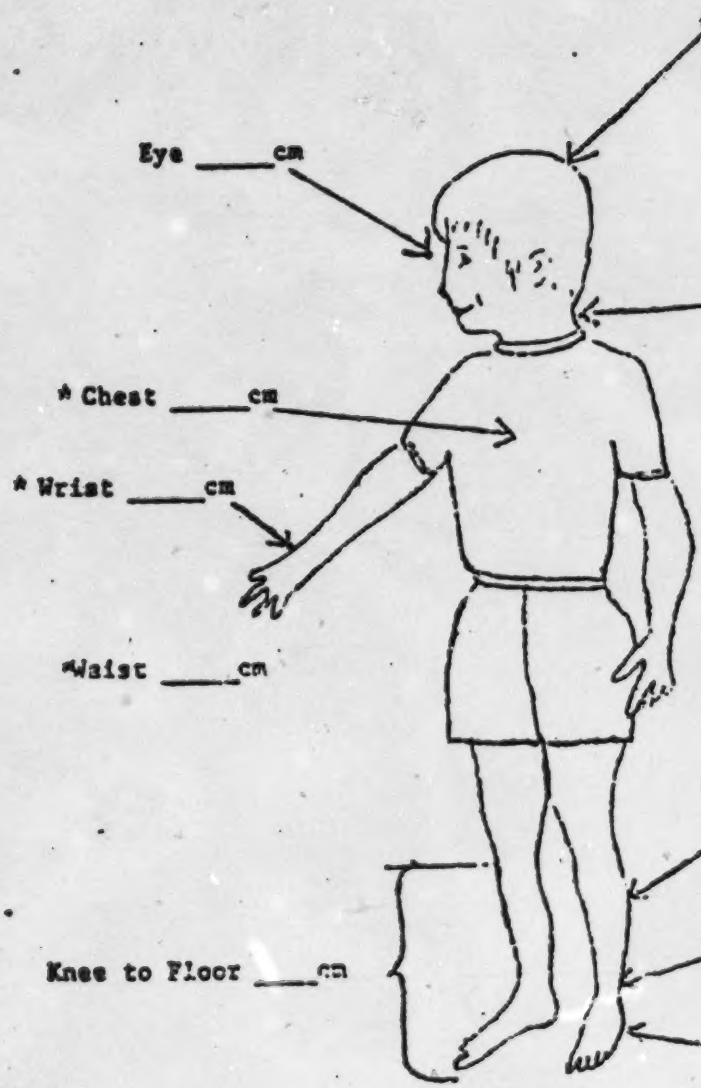
# Obtain and complete the "Metric Me" sheet using the metric tape. (You may make your own metric tape from a strip of adding machine tape.)

Be certain to make your estimates before you make your measurements with the metric tape and metric bathroom scales.

USE AT STATION # 24

# ALL ABOUT ME

* measure circumference




Do these at other activity stations

I am _____cm tall

My mass _____ kg.

My temperature is _____ C°.

METRIC ID CARD

NAME:_____

HEIGHT IN CENTIMETERS=_____

MASS IN KILOGRAMS_____

FINGERPRINT -

METRIC ID CARD

NAME:_____

HEIGHT IN CENTIMETERS=_____

MASS IN KILOGRAMS_____

FINGERPRINT-

METRIC ID CARD

NAME:_____

HEIGHT IN CENTIMETERS=_____

MASS IN KILOGRAMS_____

FINGERPRINT-

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MASS IN KILOGRAMS_____

FINGERPRINT-

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## METRIC ID CARD

NAME:_____

HEIGHT IN CENTIMETERS=_____

MASS IN KILOGRAMS=_____

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## METRIC ID CARD

NAME:_____

HEIGHT IN CENTIMETERS=_____

MASS IN KILOGRAMS=_____

FINGERPRINT-

## METRIC ID CARD

NAME:_____

HEIGHT IN CENTIMETERS=_____

MASS IN KILOGRAMS=_____

FINGERPRINT-



USE AT STATION # 24

MATERIALS NEEDED: HECTARE CARD B, HECTARE LAND AREA GRID WORKSHEET

STATION #25

# Estimate and then use the Hectare Land Area Grid to measure the area of the Brantner farm in hectares.

Directions-

The Brantner farm is a 180 acre farm- its metric area may be expressed in hectares by placing the Hectare Land Area Grid over the scaled outline and counting the number of small grid squares within the farm border lines.

Record your estimate and measurement.

MATERIALS NEEDED: SMALL PIECE OF WOOD (2 x 10), MILLIMETER RULE, WORKSHEET

STATION # 26

# Estimate and then measure the thickness and width of this wood block in millimeters.

Record the estimate and measurement on worksheet.